

AMENDMENTS TO THE DRAWINGS

The attached sheet(s) of drawings includes changes to Fig. 9.

Attachment: Replacement sheet
 Annotated sheet showing changes

REMARKS

Applicants amend claims 1 and 4 and cancel claims 2 and 3. Hence, upon entry of this amendment, claims 1, and 4-5 are pending, of which claim 1 is independent. No new matter is added. Applicants respectfully submit that the pending claims define over the art of record.

Objection to the Drawings

The Examiner objects to Fig. 9 for minor informalities. Applicants amend Fig. 9 to address the Examiner's concern. Applicants respectfully request that the Examiner reconsider and withdraw the objection to the drawings.

Claim Rejection Under 35 U.S.C. §102

Claims 1, 4, and 5 are rejected under 35 U.S.C §102(b) as being anticipated by United States Patent No 6,257,479 to Litwinski et al. (hereafter "Litwinski"). Applicants respectfully submit that the Litwinski reference does not disclose the claimed element of externally fitting the first and second cylindrical members on a backing jig having a different thermal expansion while the first and second members are relatively expanded and then relatively contracted as compared with the backing jig so that the entire circumference of another surface of the abutment portion is in close contact with the entire outer circumferential surface of the backing jig, as required by amended claim 1.

The Claimed Invention

One advantage of the claimed invention is that because the workpieces and the jig are in close contact with the jig and subject to thermal expansion and contraction, it is possible to position the workpieces without deviation. Furthermore, because the ends of the workpieces have an identical circumferential length, no different in phase arises when friction stir welding is carried out. See page 4, line 21 to page 6, line 19, and see page 22, line 6 to page 23, line 13 of the present application.

The claimed invention takes advantage of the different thermal expansion and contraction between the workpieces and the backing jig. Namely, the heat applied to the

workpieces is higher than the heat generated during friction stir welding, and hence the thermal expansion of the workpieces by the applied heat is greater than that caused by friction stir welding. The workpieces can be externally fitted on the jig, and firmly retained by thermal contraction. Therefore, the workpieces are not detached from the jig merely by the heat generated by friction stir welding. The workpieces can be maintained with a completely circular shape, and the ends of two workpieces can have identical circumferential lengths. As a result, no phase difference is generated during friction stir welding, and the workpieces can be reliably retained on the jig.

The Litwinski Reference

The Litwinski reference does not disclose the element of externally fitting the first and second cylindrical members on a backing jig having a different thermal expansion while the first and second members are relatively expanded and then relatively contracted as compared with the backing jig so that the entire circumference of another surface of the abutment portion is in close contact with the entire outer circumferential surface of the backing jig, as required by amended claim 1. The Litwinski reference discloses the use of multiple shoes to form a substantially continuous ring having an outer diameter approximately equal to a diameter of the inner surface of the workpiece. The Litwinski reference further discloses an expandable support that has multiple support arms attached to the multiple shoes, and when the shoes are extended, the shoes are cause to mate with one another to form the continuous ring. The Litwinski reference discloses the use of the shoes to strengthen the rigidity of the tool against the pressing force of the probe during the process of friction stir welding. Although the Litwinski reference notes that the friction stir welding process can cause thermal expansion of the tool structure, nowhere does the Litwinski reference disclose the use of thermal expansion to fit the first and second members on to the backing jig *before* the process of friction stir welding, as required by independent claim 1.

Furthermore, gaps are formed between the shoes in the Litwinski reference and although a sealing material is used to make the surface smoother, the apparatus is complex and the sealing material cannot make the outer surface of the shoes completely smooth and flat, which can have an undesirable affect on the workpieces. Additionally, because multiple shoes are used to

approximate somewhat a circular shape, it is difficult for the jig to maintain a substantially circular shape as compared with the present invention which employs a cylindrical member.

Accordingly, the Litwinski reference does not disclose each and every element and limitation of independent claim 1. Applicants respectfully request that the Examiner reconsider and withdraw the rejection of independent claim 1. Applicants respectfully submit that the Litwinski reference further does not teach or suggest each and every element and limitation of independent claim 1 because the Litwinski reference is concerned with the rigidity of the tool structure whereas the claimed invention is concerned about the circularity of the workpieces and the phase difference between the workpieces.

Applicants note that the dependent claims also recite separate patentable subject matter. As such, for this and the reasons set forth above, Applicants respectfully submit that the dependent claims also define over the art of record.

Claim Rejection Under 35 U.S.C. §103

Claims 2 and 3 are rejected under 35 U.S.C. §103(a) as unpatentable over the Litwinski reference. Applicants cancel claims 2 and 3 hence the rejection is moot.

Claim 1 is rejected under 35 U.S.C. §103(a) as unpatentable over Japanese Patent Publication 2001-191183 to Shigetoshi (hereafter “Shigetoshi”) in view of United States Patent No. 5,247,634 to Whitehouse (hereafter “Whitehouse”). Applicants respectfully submit that the combination of the Shigetoshi reference and the Whitehouse reference do not teach or suggest each and every element of independent claim 1.

The Shigetoshi Reference

The Shigetoshi reference discloses that joining members (workpieces) are freely rotatably inserted into a hollow part 21 of a restricting sleeve 20 (jig). In other words, the Shigetoshi reference discloses a structure where the joining members are positioned *inside* of the jig, whereas independent claim 1 requires that the workpieces (first and second cylindrical members) are fitted *outside* of the jig. Furthermore, because the workpieces of the claimed invention is externally fitted to the jig by thermal expansion and contraction, the workpieces and

the jig are firmly attached to each other and not relatively rotatable as disclosed in the Shigetoshi reference. Hence, the claimed invention can prevent the creation of a phase difference during the friction stir welding process. Additionally, the Shigetoshi reference does not teach or suggest the element of separating the backing jig from the other surface of the abutment portion after the friction stir welding by *relatively thermally* expanding the first and second cylindrical members as compared with the backing jig, as required by amended claim 1. Nowhere in the Shigetoshi reference does it teach or suggest using *thermal expansion and contraction* to fit and remove the workpieces.

The Whitehouse Reference

The Whitehouse reference also does not teach or suggest the element of separating the backing jig from other surface of the abutment portion after the friction stir welding by *relatively thermally* expanding the first and second cylindrical members as compared with the backing jig, as required by amended claim 1. The Whitehouse reference discloses that the jig is constructed so that it can be removed through one of the end access openings, however the White reference does not teach or suggest that the jig can be removed by using thermal expansion and contraction.

Additionally, the jig in the claimed invention functions as a backing tool capable of withstanding the pressing force of the probe because the workpieces are externally fitted on the jig by thermal expansion and contraction. However, the jig in the Whitehouse reference cannot function as a backing tool and needs to use an additional tool, such as a reactive roller unit 21, to withstand the pressing force.

There is no motivation to combine the Shigetoshi reference and the Whitehouse reference because the two references disclose completely different structures of the jig and the workpieces. For example, the Shigetoshi reference discloses that the jig is positioned outside of the workpieces in order to prevent the workpiece from deforming during friction stir welding while in the Whitehouse reference, the jig is positioned inside of the workpieces.


Accordingly, the combination of the Shigetoshi reference and the Whitehouse reference do not teach or suggest each and every element and limitation of independent claim 1.

Applicants respectfully request that the Examiner reconsider and withdraw the rejection of claim 1.

In view of the above amendment, Applicants believe the pending application is in condition for allowance.

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Respectfully submitted,

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Attachments

